

CLAIMS

What is claimed is

1. A composition of matter for dental restoration and bone implants and restoration comprising, in combination:

a non-toxic non-aqueous water-miscible liquid;

a powdered calcium compound selected from the group consisting of monocalcium phosphate monohydrate, monocalcium phosphate anhydrous, dicalcium phosphate anhydrous, dicalcium phosphate dehydrate, octacalcium phosphate, α -tricalcium phosphate, β -tricalcium phosphate, amorphous calcium phosphate, calcium deficient hydroxyapatite, non-stoichiometric hydroxyapatite, tetracalcium phosphate, CaSO_4 , $\text{CaSO}_4 \cdot 0.5 \text{H}_2\text{O}$, $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$, CaO , $\text{Ca}(\text{OH})_2$, CaCO_3 and mixtures thereof; and

an organic acid for forming calcium complexes when reacted with the calcium compound in the presence of water.

2. The composition of Claim 1 including a gelling agent.
3. The composition of Claim 2, wherein the gelling agent is selected from the group consisting of hydroxypropyl methyl cellulose, carboxymethyl cellulose, chitosan, collagen, gum, gelatin, and alginate, and combinations thereof.
4. The composition of Claim 1, wherein the organic acid is a carboxylic acid.
5. The composition of Claim 4, wherein the carboxylic acid is selected from the group consisting of glycolic, citric, tartaric, malonic, malic, and maleic acids and combinations thereof.
6. The composition of Claim 1, wherein the liquid is selected from the group consisting of glycerin, propylene glycol, poly(propylene glycol), poly(ethylene glycol) and mixtures thereof.
7. A paste for bone and tooth restoration comprising, in combination:

an essentially water-free mixture of calcium compound powder, a non-toxic non-aqueous water-miscible liquid and carboxylic acid.
8. The paste of Claim 7 wherein the calcium compound powder comprises tetracalcium phosphate.

9. The paste of Claim 8, wherein the tetracalcium phosphate has a calcium to phosphate molar ratio of between about 1.67 to about 2.
10. The paste of Claim 7 wherein the calcium compound powder comprises tricalcium phosphate.
11. The paste of Claim 10, wherein the tricalcium phosphate has a calcium to phosphate molar ratio of between about 1.5 to about 1.67.
12. The paste of Claim 7, wherein the calcium compound powder comprises tetracalcium phosphate and dicalcium phosphate anhydrous.
13. The paste of Claim 7, wherein the powder has a particle size of between about 1 to about 200 μm .
14. The paste of Claim 13, wherein the powder has a particle size of between about 2 to about 50 μm .
15. The paste of Claim 7, wherein non-toxic non-aqueous water-miscible liquid is selected from the group consisting of glycerin, propylene glycol, poly(propylene glycol), poly(ethylene glycol) and mixtures thereof.
16. The paste of Claim 7, wherein the carboxylic acid is selected from the group consisting of glycolic, citric, tartaric, malonic, malic, and maleic acids and combinations thereof.
17. The paste of Claim 7, wherein the mass ratio of powder to liquid is in the range of 1.5 to 1 to 3 to 1.
18. A method of preparing a paste for bone and tooth restoration, the method comprising:
 - (a) formulating a composition comprising a non-toxic non-aqueous water-miscible liquid; powder selected from the group consisting of monocalcium phosphate monohydrate, monocalcium phosphate anhydrous, dicalcium phosphate anhydrous, dicalcium phosphate dehydrate, octacalcium phosphate, α -tricalcium phosphate, β -tricalcium phosphate, amorphous calcium phosphate, calcium deficient hydroxyapatite, non-stoichiometric hydroxyapatite, tetracalcium phosphate, CaSO_4 , $\text{CaSO}_4 \cdot 0.5 \text{H}_2\text{O}$, $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$, CaO , $\text{Ca}(\text{OH})_2$, CaCO_3 and mixtures thereof; and an organic acid for forming calcium complexes with the calcium powder, the composition being formulated under substantially anhydrous conditions; and
 - (b) storing said composition under substantially anhydrous conditions.

19. The method of Claim 18, further comprising mixing a gelling agent with the composition, the gelling agent effective for enhancing paste cohesiveness.
20. A method of repairing bone and tooth defects comprising:
 - (a) filling the defect with the composition of any of claims 1-6; and
 - (b) contacting the composition with an aqueous fluid to promote hardening of the composition.
21. The method of claim 20, wherein the composition is mixed with the aqueous fluid prior to filling the defect with the composition.
22. The method of Claim 20, wherein the composition is contacted with the aqueous fluid subsequent to filling the defect with the composition.
23. A method of repairing bone and tooth defects comprising:
 - (a) filling the defect with the paste of any of claims 7-17; and
 - (b) contacting the composition with an aqueous fluid to promote hardening of the composition.
24. The method of claim 23, wherein the paste is mixed with the aqueous fluid prior to filling the defect with the composition.
25. The method of Claim 23, wherein the paste is contacted with the aqueous fluid subsequent to filling the defect with the composition.